EXHIBIT B

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel,	§	
W. A. DREW EDMONDSON,	§	
in his capacity as ATTORNEY GENERAL	§	
OF THE STATE OF OKLAHOMA,	§	
and OKLAHOMA SECRETARY	§	
OF THE ENVIRONMENT	§	
C. MILES TOLBERT, in his capacity as	§	
the TRUSTEE FOR NATURAL RESOURCES	§	
FOR THE STATE OF OKLAHOMA,	§	
	§	
	§	
Plaintiff,	§	CASE NO. 05-CV-329-GKF-SAJ
	§	
V.	§	
	§	
TYSON FOODS,	§	
TYSON POULTRY, INC., TYSON CHICKEN, INC.,	§	
COBB-VANTRESS, INC., AVIAGEN, INC.,	§	
CAL-MAINE FOODS, INC.,	§	
CAL-MAINE FARMS, INC., CARGILL, INC.,	§	
CARGILL TURKEY PRODUCTS, LLC,	§	
GEORGE'S, INC., GEORGE'S FARMS, INC.,	§	
PETERSON FARMS, INC., SIMMONS FOODS, INC.	§	
AND	§	
WILLOWBROOK FOODS, INC.	§	

Defendants.

EXPERT REPORT OF GORDON V. JOHNSON, Ph.D

1. Introduction

I, Gordon V. Johnson, grew up and lived on a small diversified farm in North Dakota until attending North Dakota State University, where I received a B.S. in agriculture majoring in Soil Science in 1963. I received a M.S. in Soil Science from the University of Nevada (Reno) in 1966 and a Ph. D in Soil Science from the University of Nebraska in 1969. From 1969 to 1977 I taught undergraduate

a. Phosphorus is one of 16 chemical elements essential for plants to grow and complete their life-cycle. Three of the elements, carbon (C), hydrogen (H) and oxygen (O) are supplied through absorption from air and water. The remaining 13 are absorbed primarily from the soil and are categorically grouped according to their common deficiency in soils, which is also closely related to the amount used by plants. Nitrogen (N), P, and potassium (K) commonly become deficient in intensively cropped soils because plants contain large amounts of these nutrients compared to available soil levels. They are classified as "primary nutrients" or "macronutrients". Less commonly deficient are the "secondary" nutrients calcium (Ca), magnesium (Mg) and sulfur (S). The "micronutrients" iron (Fe), manganese (Mn), copper (Cu) zinc (Zn), boron (B), chlorine (Cl) and molybdenum (Mo) are found in the lowest concentration in plants and are seldom deficient in soils.

b. Plants use much larger amounts of N (1 to 3 %) and K (about 1 %) than P (about 0. 2 to 0.4 %). Phosphorus is absorbed by plants in the form of orthophosphate, an inorganic anion of single ($H_2PO_4^-$) or double charge ($H_2PO_4^{2-}$). A primary function of P within the plant is in energy transfer, as a component of ADP (adenosine di-phosphate) and ATP (adenosine tri-phosphate), and it is easily transferred from old tissue to new tissue when soil supplies are deficient. Deficient leaves become discolored, and appear chlorotic (yellow) and often purple.

5. <u>Nutrient Management.</u>

a. The management of nutrients for agronomic production developed as farmers and soil scientists observed that crop yield could be maintained in intensively cropped fields with the addition of fertilizer. Early in American agriculture fertilizer materials included animal manure, rock phosphate, wood ashes, and various forms of mined nitrates. The amounts of these materials applied to a given field depended upon the cost and availability of the materials. Use of these fertilizers was also influenced by the anticipated increase in crop yields. Early research led to the common understanding that crops most often responded to soil inputs of nitrogen (N) phosphorus (P) and potassium (K), although other "secondary" (Ca, Mg, and S) and "micronutrients" (Fe, Zn, Mn, Cu, B, Cl, and Mo) were also essential for plant growth and development. Therefore, interest grew in developing technology that could identify how much N, P, or K should be applied to a field to gain the maximum crop yield at the least cost. The development of soil test procedures for N, P, and K followed.

b. Although most soil P exists in solid form and plants absorb water soluble P, neither soil analysis evaluating water soluble P nor total soil P accurately predicted the soils capacity to provide a crop's P need for maximum crop yield. Instead, chemical extractants were developed that successfully mimicked plant use of P. Using these extractants a relationship was developed between P extraction amounts (soil test P, or "STP") and crop yield. This relationship is called soil test <u>correlation</u>. Finally, the STP results were related to crop yield response from fertilizer P addition through field experiments performed on farmer's fields and at OSU Agricultural Experiment Stations. The result of this work is that the tests are <u>calibrated</u>, and we know that an STP of 65 lb P/acre (ppm times a factor of 2.0 is equivalent to lb/acre) provides a maximum benefit of 100% P sufficiency for efficient forage crop production of bermudagrass and fescue and an STP of 40 provides 95% yield sufficiency for these crops. Because there is no P benefit to crops once the STP is 65 lb/acre or higher, this STP becomes the agronomic critical level (ACL). Bermudagrass and fescue are the predominate forages grown in the IRW.

c. These correlation-calibration P relationships that establish good agronomic use of P as a fertilizer have been published by the Oklahoma State University in OSU Bulletins and "Fact Sheets" that include tables showing the relationship and the need, if any, for additional P as a fertilizer to accomplish maximum crop yield. These publications include a table showing the categorization of soil test results and identify a STP value of 65 as being adequate , i.e., any additional input of P fertilizer would have no agronomic benefit. This calibration was originally published in 1965 and has been verified by field research through time (Baumann, 1965.) The following tables are reproductions of the tables that were first published in the OSU Fact Sheet 2225 (Baker and Tucker, 1973) and are in the current OSU fact sheet widely used for nutrient management and soil test interpretation (Zhang, H., et al., 2006).